



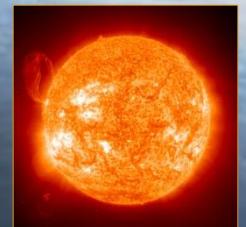
aeronomie.be

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Royal Belgian Institute for Space Aeronomy (BIRA-IASB)

Institut royal d'Aéronomie Spatiale de Belgique (IASB)

Koninklijk Belgisch Instituut voor Ruimte-Aeronomie (BIRA)



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# Space Pole in Brussels, Belgium



# Space Pole in Brussels, Belgium



## KSB-ORB

Royal Observatory of Belgium

<http://www.ksb.be>



## KMI-IRM

Royal Meteorological Institute

<http://www.kmi.be>



## BIRA-IASB

Royal Belgian Institute for  
Space Aeronomy

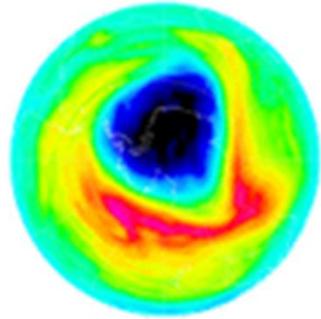
<http://www.aeronomie.be>

# Research at BIRA-IASB

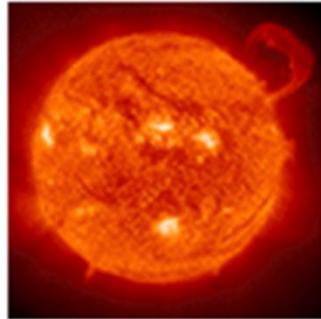
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Climate



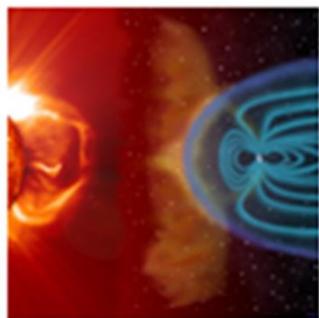
Ozone



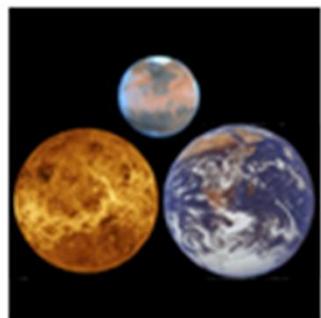
UV



Air Quality



Space Physics



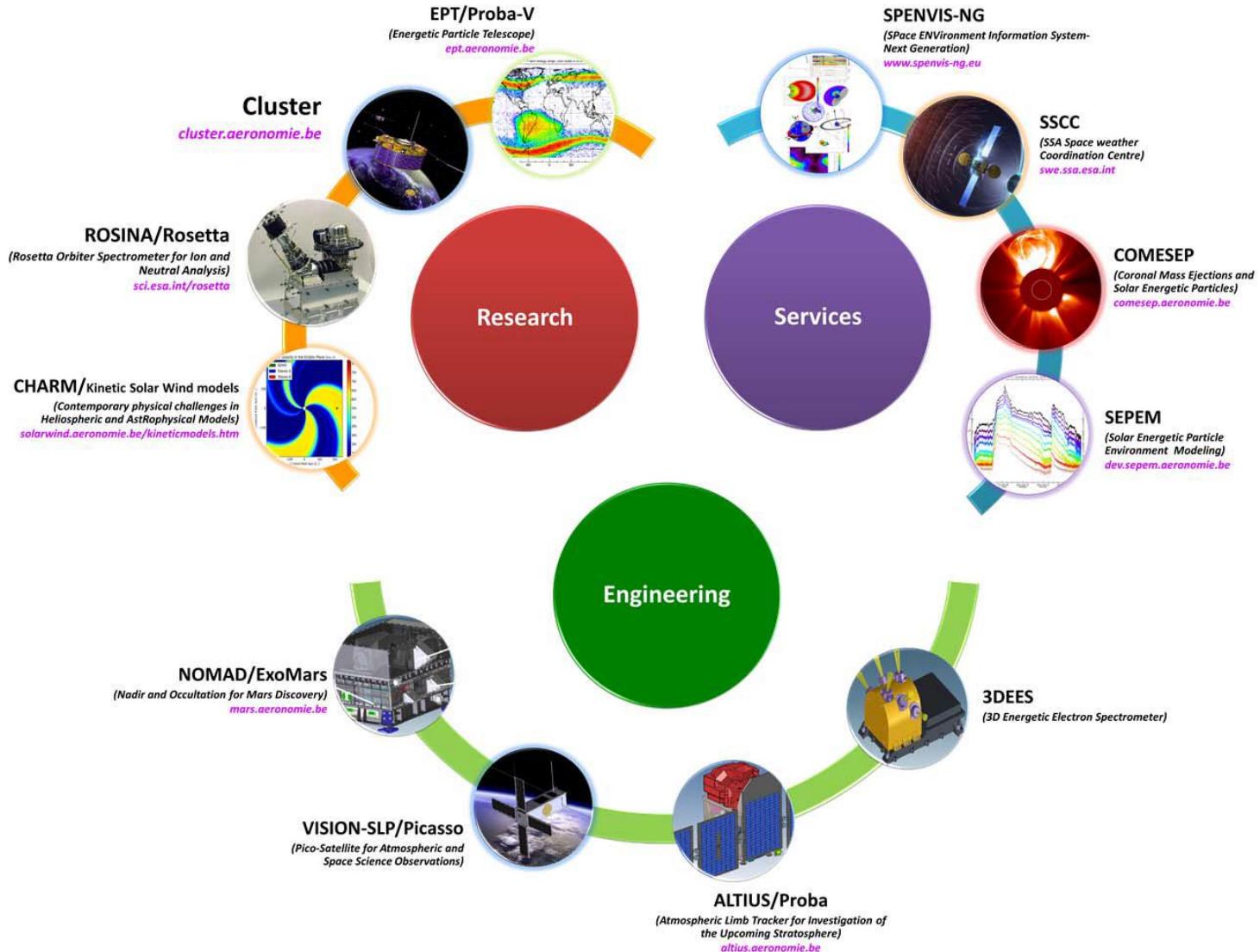
Planetary  
Aeronomy



Scientific  
Services

# Space weather activities

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# SPENVIS Next Generation

Stijn Calders  
on behalf of the whole project team:



# Presentation outline

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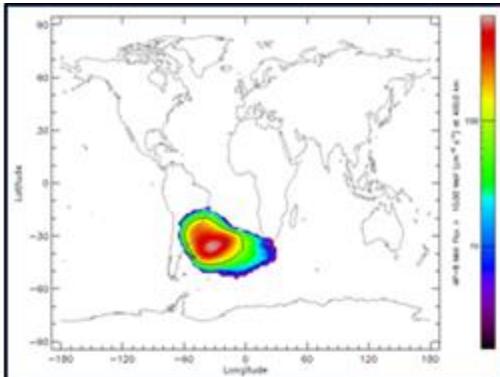
- SPENVIS, the Space Environment Information System
- SPENVIS Next Generation
- Supporting the model developers
- Collaboration with CCMC

# WHAT IS SPENVIS?

<http://www.spenvis.oma.be>

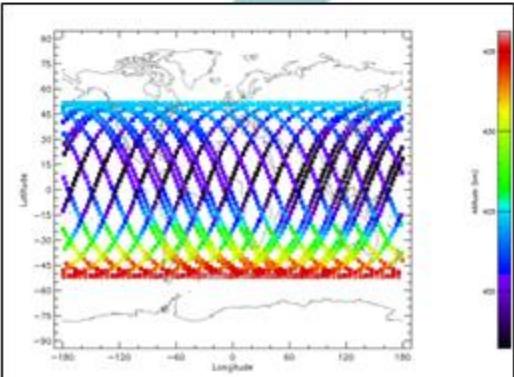
# Space Environment Information System (SPENVIS)

The AP-8 MIN proton flux ( $> 10$  MeV) in the SAA region at ISS altitude



Planet -  
Mission

ISS orbit

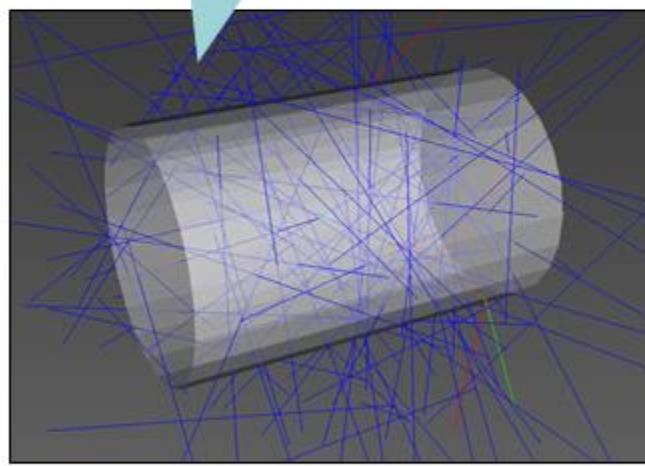
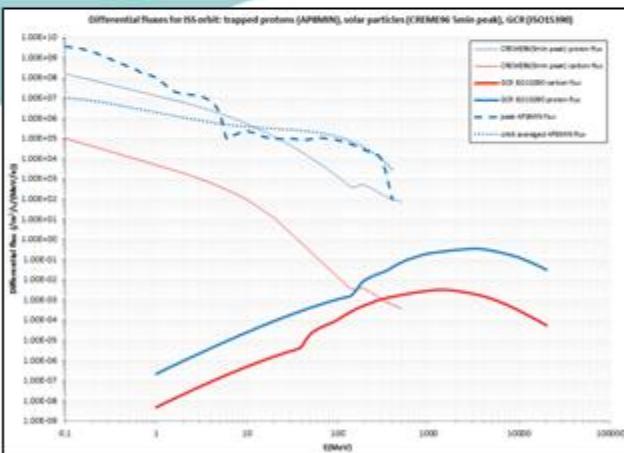
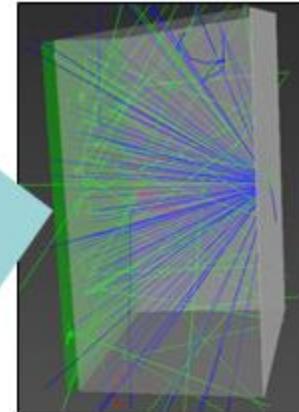


Radiation environment encountered  
by the ISS (fluxes corrected for  
geomagnetic shielding)

Effects



Environment



Dose calculations with Geant4  
transport simulation tools  
(GRAS & MULASSIS)

# SPENVIS Legacy

- ESA Operational software publicly available since 1998
- Developed & maintained for ESA by BIRA-IASB since 1996
- Also federated in ESA's Space Situational Awareness (SSA) Space Weather Service Network
- Large User Community:
  - More than 16000 registered users (~30% from the US)
  - On average 500 active users per month
  - Space industry, scientific community, Universities & Colleges

<http://www.spenvis.oma.be>



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**Coordinate generators**  
**Radiation sources and effects**  
**Spacecraft charging**  
**Atmosphere and ionosphere**  
**Magnetic field**  
**Meteoroids and debris**  
**Miscellaneous**  
**Geant4 Tools**  
**General models**  
[Multi-Layered Shielding Simulation \(MULASSIS\)](#)  
[Geant4 Radiation Analysis for Space \(GRAS\)](#)  
[Geant4-based Microdosimetry Analysis Tool \(GEMAT\)](#)  
[Sector Shielding Analysis Tool \(SSAT\)](#)  
**Planet specific models**  
[Magnetocosmics](#)  
[Planetocosmics](#)  
**Common settings**  
[Definition of source particles \(former version\)](#)  
Definition of physics models  
[User defined materials](#)  
[Geometry definition tool](#)  
**ECSS Space Environment Standard**



# Upcoming release (planned for May 2)

- Slot Region Radiation Environment Model (SRREM)
- Solar Accumulated and Peak Proton and Heavy Ion Radiation Environment (SAPPHIRE)
- GRAS 4.0 & MULASSIS 1.26
  - compiled with Geant4.10.3
- IRENE AP-9/AE-9 1.50

# SPENVIS NEXT GENERATION

<http://www.spenvis-ng.eu>

# Why do we need a new system?

Lack of flexibility  
in model coupling

Limited  
capabilities for  
the import of  
user data

No formal  
machine-to-  
machine interface

Artificial splitting  
between orbital  
and positional  
models

Plug-in of new  
models is not  
so easy

# SPENVIS Next Generation

- Complete re-design of the current SPENVIS system
- Funded by ESA's **GSTP** programme
- The new framework has a modular architecture which allows a **distributed deployment**
- The current SPENVIS system is model oriented, while the new one is **task oriented**
  - Introduction of the workflow concept



# SUPPORTING THE MODEL DEVELOPERS

# Software Development Kit (SDK)

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- Can be installed locally and checks the development environment
- Toy model & SPENVIS-NG extension bundles
- XML Validation tool for manifests & workflows
- Tool for interacting with a remote execution node
- SDK follows the system development
- Software Development Kit and Remote Execution Node **Manual**
  - Tutorial guide (Linux & Windows users)
  - Hints & tips section
  - Installation & configuration of remote execution node

# Application Programming Interface (API)

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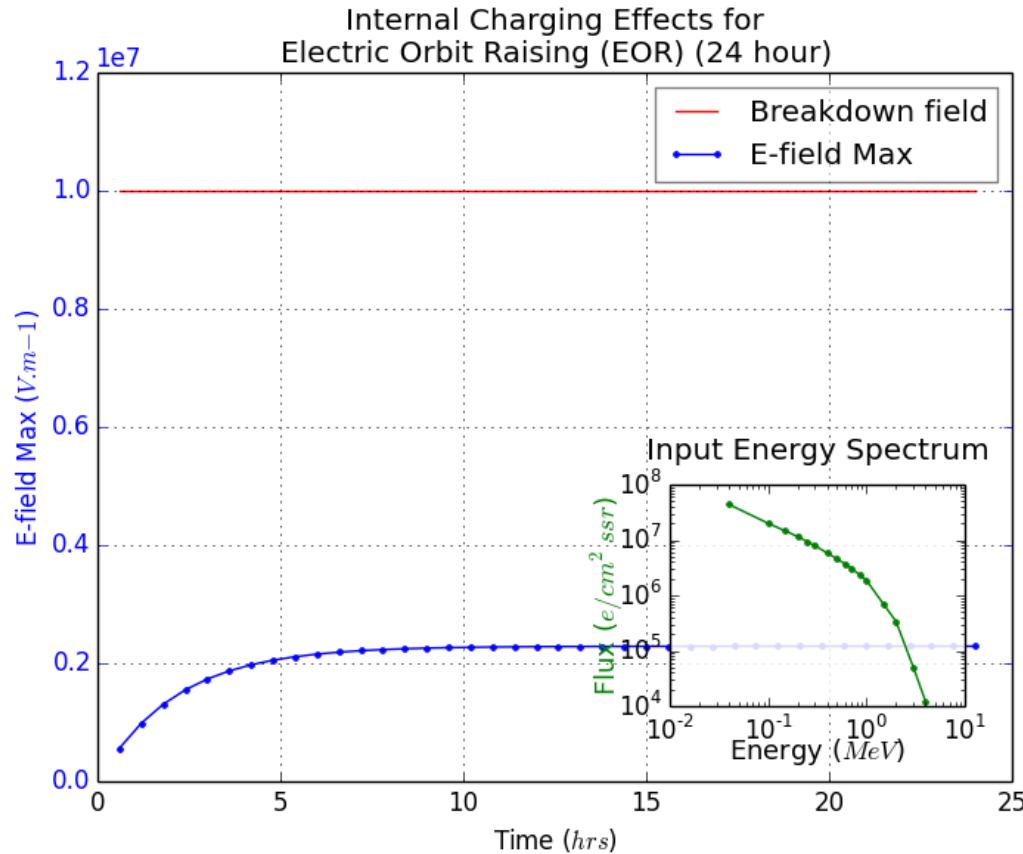
- Machine-to-machine interface
- Based on **SOAP web services** exposed by the SPENVIS-NG Back-End server
- An **API** has been developed in Python; it can either be used as
  - A command-line interface (CLI) using INI-style configuration files
  - A **Python 2.6 library**



# COLLABORATION WITH CCMC

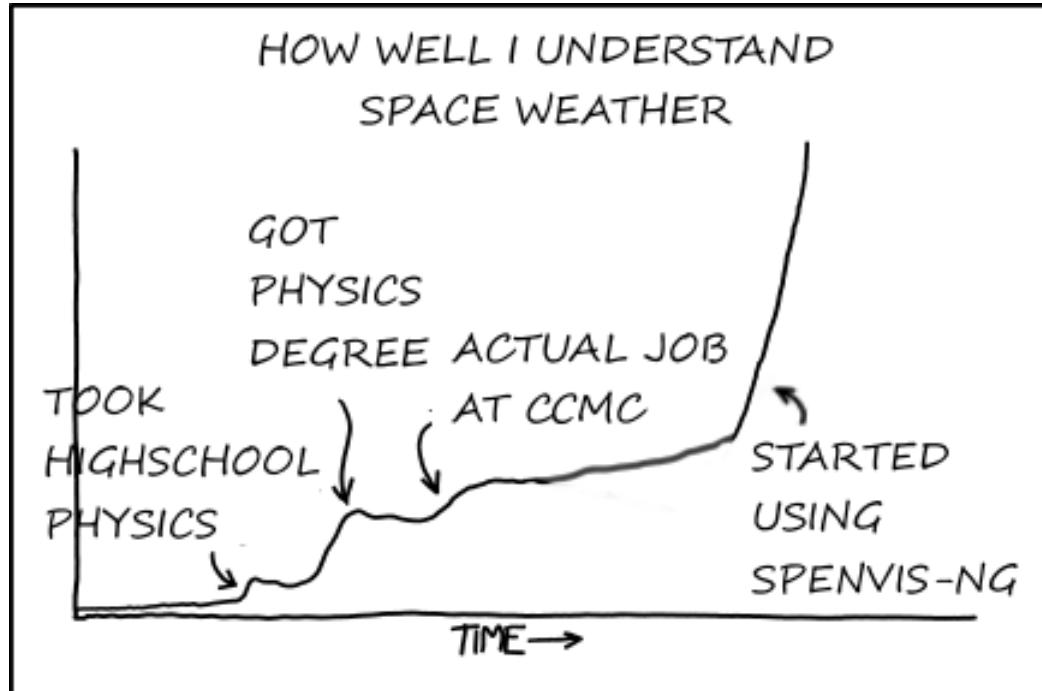
# Collaboration with CCMC

- Internal charging calculations using DICTAT
- CCMC is testing the SPENVIS-NG API



# Thank you!

[Stijn.Calders@aeronomie.be](mailto:Stijn.Calders@aeronomie.be)



\* Based on <https://xkcd.com/1356/>